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Dropped Hallux after Interlocking Nailing of Tibial Fractures

Senthilkumar Ranganathan[1], Kartheesan Ganesan[2*]

[1, 2]Assistant Professor, Department of Orthopaedics, Government Tiruvannamalai Medical College, Tamilnadu, India
*Corresponding Author: **Kartheesan Ganesan**

Abstract: ***Intramedullary nailing is commonly done for Tibial shaft fractures. Between May 2012 and November 2013, we studied prospectively 77 tibial diaphyseal fractures with or without Fibular fracture. All patients were evaluated clinically for any neurological injury preoperatively. All patients were evaluated clinically for any signs of compartment syndrome or any neurological deficit in postoperative period. Patients who had dropped hallux with sensory deficit in first dorsal web space of foot without clinical involvement of Tibialis anterior and Extensor digitorum longus were followed up regularly to assess the improvement in neurological status. Nerve conduction study was done in all patients. Out of seventy seven patients, seven developed dropped hallux. Isolated Extensor hallucis longus (EHL) weakness is an underreported complication following tibial interlocking nailing. This is an iatrogenic injury and can be prevented by minimizing the risk factors.***

Keywords: Dropped Hallux, Extensor hallucis longus, Interlocking Nailing, Tibia

1. Introduction

The cross-section of Tibia is triangular except in the proximal and distal regions of the metaphyses covered by skin (1/3) in the anteromedial part of the leg and muscles (2/3) of the calf. The nutrient artery of the tibia enters through the posterior cortex where the proximal and middle thirds of the tibial shaft meets. Tibial fractures are common in road traffic accidents and the treatment is varied and challenging. The treatment of tibial fractures aims to enable a fixation that is stable and minimises the soft-tissue injury. Intramedullary nailing is commonly done for the Tibial shaft fractures. The paralysis of EHL is rare in this type of repair leading to drop hallux, a condition in which the ankle can undergo dorsiflexion and the hallux cannot dorsiflex.

2. Methods

Between May 2012 and November 2013, we studied prospectively 77 tibial diaphyseal fractures (fig 1, 2) with or without fibular fracture. All patients were evaluated clinically for any neurological injury preoperatively. Interlocking nailing (fig 3, 4) was done by closed or open method with a sandbag behind flexed knee. Tourniquet was not used. Skeletal traction was not used. All patients were evaluated clinically for any signs of compartment syndrome or any neurological deficit (fig 5) in postoperative period. Patients who had EHL weakness with sensory deficit in first dorsal web space of foot without clinical involvement of Tibialis anterior and Extensor digitorum longus were followed up regularly to assess the improvement in neurological status (fig 6,7,8) . Nerve conduction study was done in all patients. Electromyogram (EMG) was done in two patients.

3. Results

The patients were within the age group of 20 years to 40 years with a majority of them being males. Out of seventy seven patients sixty six were males and eleven were females. Out of sixty six males, six developed EHL weakness. One patient among the eleven female cases developed EHL weakness. Out of seventy seven patients, Seven (9%) patients developed EHL weakness (MRC grade 0) with sensory deficit in first dorsal web space of foot in immediate postoperative period. Out of seventy seven patients, forty five were right sided tibial fracture and thirty two were left sided tibial fracture. Out of forty five right sided tibial fractures three developed EHL weakness. Out of thirty two left sided tibial fracture four patients developed EHL weakness.

Thirty seven tibial fractures were closed injuries and forty were open injuries. Out of forty open tibial fractures twenty were grade1, thirteen were grade 2 and seven were grade 3 Gustilo and Anderson. Out of thirty seven closed injuries four developed EHL weakness. Out of forty open injuries three developed (all three were grade 3a) EHL weakness.

Closed nailing was done in fifty nine cases and open nailing was done in eighteen cases. Four out of fifty nine closed nailing cases and three out of eighteen open nailing cases developed EHL weakness.

Fibular fracture was noted in upper third in one case, middle third in one case, lower third in three cases, intact in two cases.. Fibular resection was done in one case. All proximal and distal locking bolts were done transversely, except for one case where distal antero-posterior locking was done who developed EHL weakness.

Nerve conduction studies confirmed the peroneal nerve dysfunction. EHL involvement without involvement of Tibialis anterior and Extensor digitorum longus was confirmed by EMG, done in two of seven patients who developed EHL weakness. EMG showed pattern of denervation in EHL and Extensor digitorum brevis and normal potentials in Tibialis anterior and Extensor digitorum longus.

All patients showed improvement in grade of muscle power from initial grade 0 to grade 4 after 4 to 6 months. Complete motor recovery was not noted in any patient. All patients

had sensory recovery after 4 to 6 months. No patient had any functional disability.

Pre Operative

Figure 1: Anteroposterior view **Figure 2:** Lateral View

Post Operative

Figure 3: Anteroposterior view **Figure 4:** Literal View

4. Discussion

EHL weakness is not uncommon after interlocking nailing of tibial shaft fractures. It is under reported since most of it were due to transient neuropraxia and due to failure to notice it post operatively. EHL weakness is reported after interlocking nailing of tibial fractures, high tibial osteotomy, proximal fibular graft harvesting and external fixator application and after arthroscopy[1] of knee.

In our study we had 9% (7 out of 77 patients) incidence of EHL weakness following nailing of tibial fractures. Robinson et al [2] reported that 5.3 % developed this complication in his series of 208 patients. Bryon et al [3] in his series of 246 patients reported 0.8%. They had done nailing within 48 hrs in most of the cases whereas we had done nailing after a delay of more than 48 hrs in all cases needing more manipulation to reduce the fracture which might have caused the increased incidence in our study.

Figure 5: Immediate Post-op showing EHL paaralysis

Figure 6: 2 months follow up showing recovery

Figure 7: 4 months follow up sowing recovery

Figure 8: 6 months follow up showing recovery

In our study we couldn't find any significant association of sex, side of the fracture to occurrence of EHL weakness. We found increased incidence of EHL weakness in grade 3A (43%) compound injuries than in grade 1 or grade 2 compound injuries or closed injuries. Robinson et al [2] noted one grade 1 open injury developed this complication. The incidence of EHL weakness was found to be increased in open nailing (16%) than in closed nailing (7%). The exact cause of occurrence of EHL weakness could not be pinpointed though more manipulation to reduce fracture and/or use of retractors might have caused this complication. One case developed compartment syndrome post operatively and developed EHL weakness.

The site of lesion of the deep peroneal nerve was distal to origin of branches to Tibialis anterior, Extensor digitorum longus and proximal to origin of branch to EHL. If the deep peroneal nerve was involved proximally at the level of its origin, then Tibialis anterior, Extensor digitorum longus, EHL would be affected. These patients developed EHL weakness with dropped great toe with sensory deficit in first web space without involvement of Tibialis anterior and Extensor digitorum longus. This points out that the lesion is in the part of deep peroneal nerve as described above.

Cadaveric studies done by Shingade et al[4] found deep peroneal nerve gives branches to Tibialis anterior and Extensor digitorum longus at a higher level at the head of fibula whereas, the branch to EHL originate at lower level leading to sparing of the proximal muscles . Moreover proximal muscles receive multiple short thick branches whereas, EHL receives a single long thin branch vulnerable to ischaemia (tourniquet) , traction, retraction, compartment syndrome, proximal screws .

Electromyographic studies were done in two patients. They showed a pattern of denervation in EHL and Extensor digitorum brevis. They also showed normal activity in Tibialis anterior and Extensor digitorum longus confirming the level of lesion in the part of the deep peroneal nerve distal to origin of branches to Tibialis anterior, Extensor digitorum longus and proximal to origin of branch to EHL. Moorman et al[5] had reported that, spontaneous regeneration of the nerve may take upto one year in 80 percent of cases and may not recover in 20% of cases. All cases had improvement in MRC grade from 0 to 4. No case recovered to grade 5 muscle power and may need more time for further improvement in grade of muscle power. No patient required any surgical intervention in our study.

5. Conclusion

Isolated EHL weakness is an underreported complication following tibial interlocking nailing. This is an iatrogenic injury and can be prevented by minimizing the risk factors. This is presented to make aware of such complication to be recognized. Though the site of lesion could be determined, more studies are needed to find out the exact cause for this complication.

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